THE FREQUENCY OF PROTOZOIC ENTEROCOLITIS IN THE MIDDLE WEST: CLINICAL MANIFESTATIONS, DIAGNOSIS AND TREATMENT.[1]

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STUDY of the records of the last 1000 stool analyses in my clinic at Augustana Hospital indicates that therein 93 instances protozoa were observed. Inasmuch as the patients furnishing these specimens were largely from the northern half of the middle west—a region where man is commonly considered to be free from protozoic infection—it would seem not altogether valueless to review this material from its clinical aspects. Apart from those in tropical countries, but little mention of such findings exists in medical text-books. Vague, archaic descriptions of the parasites together with illustrations common to laboratory manuals for decades have been firmly engrafted on the mind, medical, throughout the country—and this in spite of the emphatic and complete articles by Darling, Craig, Deeks, Freund, Sistrunk, Lyons and Giffin. It would seem quite possible that the local and general increases in population and the ease with which people get from place to place is worth emphasis. The free intercourse between Mexico, South America, the Islands of the Far East and the Southern States of this country may be a not-to-be-neglected factor in a wider spreading of protozoic intestinal infections than has heretofore been recognized.

A. ETIOLOGICAL FACTORS OF THE GROUP. *Age.* The patients' ages ranged from seven years to eighty-two years. The average age was thirty-nine.

TABLE I.—CASES OF PROTOZOIC ENTEROCOLITIS IN THREE YEARS.

Patients with intermittent or chronic diarrhea	86
Patients without diarrhea	7
Total cases	93
Patients from south of Springfield, Ill.	4
Patients who had visited in the South	11
Patients who had never been in the South	78
Patients from small towns, rural communities or farms	70
City or large town dwellers	23
Patients who had habitually drunken well or shallow river water	78
Patients whose water supply was seemingly good	15
Patients who were large eaters of fresh garden truck, bananas or unwashed fresh fruits	66

[1] Read before the Chicago Society of Internal Medicine.

Sex. There were 51 males and 42 females. There was practically no difference noted in the sex-age figure.

Nativity. Fifty-two patients were of Scandinavian birth or extraction. The remainder were Americans, Germans, Irish, Russians, Austrians or English.

Geographic Distribution. During the past ten years we have had strongly impressed upon us the importance of gaining information when taking histories, regarding both the present and past residences of patients and also the exact environmental conditions under which they have lived. These points appear to have special significance in the examination of individuals affected with obscure abdominal ailments, particularly when such are associated with diarrhea.

The geographical diversity of patients forming this group was as follows: Illinois 29, Iowa, 16, Wisconsin 13, Nebraska 8, Michigan 7, Minnesota 6, Indiana 4, South Dakota 2, Arkansas 2, Ohio 2, Texas 2, Kentucky 1, North California 1. (Table I.)

It will be noted that but 4 patients came from regions south of Illinois. There were 11 patients who had made occasional business or pleasure trips to the Southern States. There were 78 individuals who had never been south of Illinois.

Water Supply, etc. We routinely seek information not only with respect to the patient's present drinking-water, but also regarding his drinking-water from childhood. The importance of water supply as a source of protozoic infection has been abundantly commented upon in the literature; clinically, we have gained valuable facts from seeking information about it. Not rarely patients admit that for years their drinking-water has been bad, especially such patients as have taken up residence in recently opened "homestead" territory. Shallow, dug wells, contaminated springs, sluggish, weed-grown rivers or ponds or lakes befouled by drainage systems have proved to be the source of water supply in 78 instances. In the remaining 15 cases the drinking-water was seemingly good.

The contamination of garden vegetables by dung is not unlikely responsible for protozoic spread. It is well known that hogs, cattle, sheep, barnyard fowls or snails, worms and flies are common carriers of flagellate protozoa and ameba in their intestinal canals. Instances in which cholera-form epidemics have existed on stock farms are not unknown to veterinarians. It is the usual practice to "fertilize" fields or boxes with "rich" manure in which head lettuce, radishes, tomatoes, mushrooms, celery, etc., are grown. One cannot deny that those who partake largely of these vegetables, raw and often carelessly washed, are in danger of ingesting both active and spore forms of protozoa. Of late years truck farming has become an important industry about every big city—hence the army of "manure-eaters" is not located wholly in the country. City folk who are financially able to afford the luxury of fresh

garden truck may be contaminated during the entire year. The common house-fly not infrequently contaminates fruits, particularly the banana. This fact is well known to Mexican planters who have cleared areas previously endemic with amebic dysentery, by the simple procedure of screening the banana sheds and covering dung mounds with antiseptics, sand or oil. It is quite possible that the prevalence of protozoa in the mouths of individuals in both tropical and temperate countries is due to food and water contamination. These parasites live in filth; if the filth is supplied in the mouth by eroding gums and decaying, dirty teeth (as in pyorrhea) the parasites may thrive and do harm. Soggy tonsils, cancerous, syphilitic, phagedenic or tuberculous ulcers likewise furnish an ideal camping-ground for these unwelcome guests. If the hydrochloric acid of the stomach did not inhibit or destroy these parasites it is not unlikely that intestinal infection would be more universal. What controlling effects digestive enzymes, bile salts or intestinal flora have on these organisms is not known. The mechanical activity of the stomach, duodenum and jejunum may prevent lodgment and multiplication in these parts of the gut, while the stagnation and increased bacterial proliferation of the terminal ileum and of the large bowel may furnish from time to time the proper habitat for protozoic lodgment and growth. That protozoa may exist for a long time without causing symptoms is evidenced by Willets' report that 85 per cent. of all Philipinos habitually harbor these parasites and that but intermittently (spring and summer) do they enormously multiply and produce local and systemic effects.

Of our 93 cases, 66 patients were consistent eaters of fresh garden truck, unwashed fresh raw fruits or bananas.

B. Clinical Symptomatology.

TABLE II.—DIARRHEA PATIENTS.

Duration.	
Less than one year	8
Between one and three years	27
Between three and five years	31
Between five and ten years	12
More than ten years	8
Total cases	86
Attacks of diarrhea—Least number	3 in all
Maximum number	9 yearly
Diarrhea, chronic and continuous (summary of 72 cases)	14 cases

1. *Diarrhea.* In our series this was a presenting complaint in 86 cases. Diarrheic stools without frequent evacuations were not rarely passed chronically, with periods when the movements were frequent. The *intermittency of frequent diarrheic stools, with apparently normal motions in the intervals is quite characteristic of this affection* and aids in differentiating it from the diarrheic stools asso-

ciated with gastric or pancreatic achylia, imperfect liver function, tuberculous or luetic ulceration of the bowel and the like in which ailments the *constancy* of the soft or fluid stools is a common observation. In the event of the diarrheas associated with protozoa, the patient may note no change in his habit, mode of life or diet, but quite suddenly may experience frequent evacuations of the bowels. Occasionally a period of severe mental or physical overstrain or an attack of la grippe, tonsillitis or the like are stated as preceding the diarrhea. The attacks may be infrequent or may come close together over a period of many years. The latter event may supervene upon the former. In our series one patient had had but three attacks, while another case had experienced nine in one year. There were 14 patients in whom the diarrhea had been continuous.

The duration of the diarrhea varies greatly. (See Table II.) Sixty-seven per cent. of our cases had been affected from one to five years; 8 cases had been ill less than one year, while a like number had been ailing for more than ten years; the longest period being forty-three years.

TABLE III.—SUMMARY OF CLINICAL SIGNS AND SYMPTOMS.

(Figures Stand for Number of Cases.)

Clinical observation.	Parasite.					
	Ameba.	Cerco-monas.	Tricho-monas.	Lamblia.	Mega-stoma.	Balan-tidium.
Diarrhea	24	33	20	5	2	2
Constipation	1	2	0	0	0	0
Normal stools	2	1	0	0	0	0
Abdominal pain	21	30	17	4	2	1
Dyspepsia	15	28	21	5	1.	2
Weight loss	17	30	21	3	2	2
Achylia gastrica	13	12	11	2	1	1
Subnormal acid	8	14	8	2	0	1
Normal gastric acid	6	10	2	1	1	0
Anemia	26	31	18	4	2	2
Eosinophilia (above 3 per cent.)	19	27	15	2	1	1
Blood in stools	14	17	16	3	2	2
Fever	4	1	2	0	0	0
Chill	2	3	2	1	0	1

In character the diarrhea is commonly of the gassy type, without discomfort upon the passage of the stool. Occasionally an associated inflammatory change in the colon, especially in the sigmoid or rectal sections, results in painful evacuations. Hemorrhoids were present in 38 per cent. of our cases. They may become extremely annoying when the motions are very frequent and watery.

The bowel movements are generally easy, but prolonged diarrhea may lead to marked tenesmus and prostration.

Constipation occurred in 4 of our cases, in fact, the most toxic patient appeared for the relief of an obstinate intestinal stasis. Routine examination of the freshly passed stool following saline catharsis disclosed enormous numbers of entamebæ in the histolytica stage and actively motile cercomonads.

2. *Dyspepsia.* This was a prominent complaint in 75 cases (75 per cent.). The dyspepsia was generally associated with nausea (particularly in the morning), eructations of foul gas, regurgitation of sour-food mixtures (even when the stomach analyses revealed absent or low gastric acid), gassy distention of the abdomen, soreness after eating, loss of appetite and occasionally vomiting.

3. *Abdominal Pain or Discomfort.* Abdominal pain or discomfort was a complaint in 89 instances (95.6 per cent.). The discomfort was variously described as colicky (like gas pains following abdominal exploration), soreness, distention, cramp-like, "dragging" or vague "weak feelings." Sometimes the rapid peristaltic movements of the small gut were productive of an annoying discomfort even though actual pain were absent.

4. *Weight Loss.* This was noted in 75 cases (80 per cent.). The loss varied from 5 pounds to 104 pounds. The average loss was 17.3 pounds. Some weight losses were so striking and so rapid as to bring the patient under observation for suspected, atypically located malignancy: a young woman affected with entamebæ and cercomonads lost 104 pounds in less than one year; a middle-aged woman lost 80 pounds in less than fifteen months; a man, aged eighty-two years lost 65 pounds in less than ten months. With the exception of the first case these patients nearly doubled their weights during the year following treatment. The first-mentioned female gained 28 pounds within three months of her discharge from the hospital.

5. *Strength Loss.* Strength loss is often striking even though the weight may have decreased comparatively little. Apart from the possible toxic effect of the protozoic infection, loss of sleep due to diarrhea, imperfect assimilation or diminished quantity of ingested food, continuous abdominal discomfort, anemia and the dread of the existence of an incurable ailment seem to be important factors in the production of a general, systemic weakness.

6. *Anemia.* Anemia is usually evident even though in some cases it may not be pronounced. It is sometimes of a grave degree: certain patients are sent in as pernicious anemia cases or as atypical anemias of unknown etiology.

7. *Mental Attitude.* A peculiar malaise of melancholia is frequently observed. It may be due to a dread of impending evil, continuous headaches (especially common in some instances), weakness, anemia, loss of sleep, abdominal distress or toxic substances occurring as a consequence of the bowel upset.

C. PHYSICAL EXAMINATION.

The patients generally appear both starved and toxic; in this respect the individuals past middle age closely resemble those with malignant disease. The skin often exhibits a dusky sallow pallor. It is not rarely dry and wrinkled. Subcutaneous fat is lost quite early, although not so early as in malignant disease. There is liable to be edema about the ankles in the severe cases. The visible mucosæ are generally pale, dry and scaly. The saliva is often scant and tenacious. The tongue is usually swollen, marked by the teeth and heavily coated. The breath is heavy and often foul. Focal infections about the nasal passages, teeth and tonsils are not uncommon, but such are not characteristic for this affection.

Thoracic examination often discloses shallow respirations of increased rate, and when weight and strength loss have been rapid such are associated with anemia, signs of lung edema. The heart rate may be slowed, but upon exertion it increases out of reasonable proportion to the amount of exercise. Murmurs, generally systolic, are not uncommon in such cases.

Abdominal inspection revealed visible peristalsis over the small bowels in 22 of our patients (23 per cent.). The waves were often strikingly visible and of very rapid rate. In several instances peristalsis was seen only following sharp tapping of the belly wall with the fingers. Patients had sometimes felt the actively moving small gut and were under the impression that snakes, tape-worms, etc., had developed within them.

Palpation usually made out both small and large bowels filled with gas and feces. This was a common observation in the diarrhea cases. Distention of the terminal ileum was frequently pronounced —the coils felt as large as loops of normal colon.

Tenderness over the small and large gut was noted in 64 cases (69 per cent.). In severe diarrhea it was often marked. Tender areas over the gall-bladder or appendix zones was present in 83 instances (88 per cent.). The liver was enlarged and tender in 3 patients. The spleen was palpable 9 times: in 4 there was definite enlargement.

Rectal Examination. The frequency of hemorrhoids has already been commented upon.

Proctoscopic examinations were made in the last 37 cases coming under observation. Bleeding ulcers were noted in the sigmoid or upper rectum 9 times. In 21 cases a diffuse, catarrhal or granular inflammation of the gut was seemingly of greater grade than the frequent bowel evacuations alone would explain. In these cases the bowel was easily traumatized and in some instances the bleeding following instrumentation was rather severe.

D. LABORATORY EXAMINATIONS.

1. *Stools.* For the detection of protozoa it is absolutely essential that the stool be properly collected. Our procedure is as follows:

Any medicines which the patient may have been taking are stopped. He is then placed upon a liquid diet for thirty-six hours. At the expiration of this period he comes to the clinic. He is given 1 ounce of Epsom salt or 500 c.c. solution of citrate of magnesia upon an empty stomach. The first stool passed is discarded; the second or subsequent stools are collected in a warmed container, mixed with one-fourth volume of warm normal saline solution and examined at once, by high power, in thin smears placed upon warmed glass slides on the hot stage of a microscope. None of the ready-made warm stages are satisfactory. After trying all forms we have come back to the copper plate heated by a Bunsen microburner placed upon the ordinary microscope stage. If such is not at hand an old-time carbon electric bulb placed beneath the microscope stage after the Abbe condenser has been swung to one side answers very well. In suspected cases examination is made of at least six slides before negative opinion is given. Very often examinations are made daily for even as long as a week when the history is suggestive. Frequent examinations of different stools often not only detects parasites that might have been missed but leads to the discovery of multiple infections. High power should be used in the examinations, particularly for entamebæ, because the differentiation of the types may rest upon careful study of cellular architecture. Stained specimens are best prepared by the Hastings-Giemsa method suggested by Darling.[2]

2. *Macroscopic Examination of Stools.* The stools are commonly of a greenish-brown or yellow color and of a purée-like consistency, intermixed with flakes of mucus and food bits. They may be blood-streaked or foamy. The *reaction* is usually definitely alkaline. The odor is often quite characteristic: a peculiarly penetrating, pungent mustiness that sometimes is definitely ammoniacal. When there is much blood or necrotic tissue the foul, acrid, putrid odor is disgustingly nauseating.

[2] Fresh coverslip preparations containing a sufficient number of entamebæ to warrant staining and study, or those intended for diagnosis, are made into smears by sliding off the cover slip and thoroughly drying both slip and slide, after which each is stained with Hastings's stain for fifteen minutes. Satisfactory films are then overstained with Giemsa's stain until the film has a diffuse reddish purple tint. The film is then plunged into 60 per cent. ethyl alcohol containing about 1 per cent. of water of ammonia (10 per cent.), and differentiated in this, washed in water, and controlled by the microscope until the purple substance of the nucleus and the blue color of the cytoplasm are strongly contrasted. The film when properly differentiated has a blue-violet color. If the film has been greatly overstained, it is treated with a momentary douche of 95 per cent. alcohol. Beautiful pictures are obtained in this way, but, what is of more importance, the various figures displayed by the purple staining substance (karyosome?) can be noted and followed with ease. This purple staining substance, in the nucleus of Entameba tetragena in dried-fixed films, represents only a portion of the nucleus, as the centriole and peripheral chromatin do not stain purple by the above method. The purple staining substance in the nucleus of Entameba tetragena frequently appears as a ring, or as a reticulum, or scattered granules.

3. *Microscopic Study.* The most striking feature of the stools, apart from the parasites, lies in the presence of enormous numbers of large and small, motile and non-motile bacilli or spirillæ. Indeed, such great numbers of bacteria often urge one on to examination of of many specimens for protozoa when the first slides have proved negative. Frequently the bacteria are so numerous as to resemble a hanging-drop from a bacterial culture.

In addition to bacteria are generally noted actively budding yeasts, chains or groups of cocci or of torulæ, scattered collections of mucous corpuscles or leukocytes and occasional, usually partly degenerated, red blood cells. In some smears, ammonium triple phosphate crystals and leucin plates and fatty acid needles are often very abundant. There are generally considerable undigested vegetable tissue and partly broken-up muscle bundles when the patient has been on a fairly full diet.

4. *The Protozoa.* As already stated persistent search is often necessary before the organism can be properly seen and identified. This applies particularly to entamebæ; the flagellates are readily recognized by one with the common training in parasitology. There is still considerable debate respecting the identity of entamebæ histolytica and tetragena. We have followed the classifications of Darling and of Craig in considering the cellular variations to represent different stages of the same organism. The histolytica stage appears to represent the organism at its maximum of activity and probably pathogenicity.

In our series of cases the incidence of the protozoa was as follows:

TABLE IV.

Cercomonas intestinalis hominis	36
Trichomonas intestinalis hominis	21
Entamebæ—Histolytica stage	17
Tetragena stage	6
Unclassified	4
Entamebæ total	27
Lamblia intestinalis hominis	5
Megastoma entericum	2
Balantidium coli	2
Grand total of cases	93

COINCIDENT INFECTIONS.

Cercomonas with entamebæ	12
Trichomonas with entamebæ	14
Cercomonas, trichomonas and entamebæ	4
Trichomonas and cercomonas	8
Cercomonas and lamblia	3
Cercomonas, trichomonas and lamblia	2
Trichomonas, cercomonas and megastoma	1
Trichomonas and balantidium	2

5. *Chemical Examination of the Stools.*

(*a*) *Blood.* Altered blood was demonstrated in 74 instances (79 per cent.) by the benzidin test.

(*b*) *Pancreatic Efficiency Tests.* Quantitative estimation of trypsin and amylase was made by the methods of Gross-Fuld-Wohlgemuth in 29 cases. In 22 instances (76 per cent.) trypsin was reduced below the normal (500 units). In 9 instances (31 per cent.) amylase was deficient.

(*c*) *Bile Pigment.* By the Schmidt bichloride test made upon stools from 46 individuals, bilirubin was present in 32 (69 per cent.) and biliverdin in 14 (30 per cent.).

6. *Gastric Analyses.* It is not infrequently stated that when protozoa are found chronically in the stools of patients of the temperate zone, such are secondary contaminations due to gastric achylia. It has not been shown why if such be the case there should not be a more universal finding of protozoa in the great group of achylias that come under observation. It is not unlikely that the rapid multiplication of protozoa and symbiotic bacteria in the intestinal canal is capable of bringing about toxic gastric or pancreatic achylias. Similar occurrences have been noted in association with typhoid fever and pellagra in our clinic and in cholera and intestinal tuberculosis by others.

In our series there were 40 cases (43 per cent.) with gastric achylia; 33 cases (36 per cent.) and subnormal hydrochloric acidity and 20 cases (21 per cent.) with normal or increased gastric HCl. In one instance of most pronounced acute infection with cercomonads and trichomonads the free HCl was 86.

The gastric motility was normal in 83 cases (89 per cent.). In 10 cases (10 per cent.) there was mild stagnation.

7. *Anemia.* In 19 instances this was sufficiently striking to suggest pernicious anemia. Study of numerous blood counts and films failed, however, to establish the disease. The characteristic anemia is of secondary type, such as is common in chronic intoxications, namely, nephritis, cancer or malnutrition. The average *hemoglobin* was rather more than 70 per cent. The average red cell count was 3,120,000. The average white cell count was 8400. The *differential counts* revealed no great abnormality apart from the tendency of the small lymphocytes to increase at the expense of the polynuclears and, in some instances, a rather high percentage of eosinophiles. There were 69 cases (74 per cent.) where the eosinophile percentage equalled or exceeded 3. There were 11 instances where it ranged between 8 per cent. and 14 per cent. In 1 case the eosinophiles reached 18.5 per cent. (an instance of amebiasis and trichomoniasis). The blood counts are liable to show higher eosinophile counts before purgation than afterward. It was not observed that blood from cases presenting clinical signs of grave intoxication gave the highest eosinophile counts: in fact the most

pronounced eosinophilias were recorded in young individuals who had presented symptoms of protozoic infection for but a few years.

8. *Urine.* In 16 instances albuminuria was noted. It is not possible to state that this finding was directly due to the presence of parasites. Many of the cases were at the age in life when traces of albumin are quite commonly found in the urine.

E. TREATMENT.

1. *General.* It is important that all local infection foci (teeth, tonsils, mouth or throat ulcers, diseased gall-bladders or appendices, etc.) should be removed before attack is made upon the intestinal infection. If such are not taken care of radically, reinfections may occur or subsequent ailments of such parts may lower general resistance sufficiently to again permit of enteric infection by protozoa. Encysted protozoa may lurk for years in the appendix or the gall-bladder. When such is the case the host is to be considered a not altogether harmless carrier.

2. *Measures to Free the Intestine of Protozoa.* A preliminary preparation of the intestinal canal enables one to quickly bring about its sterilization. In my clinic these patients are placed upon a liquid diet for two days before medical care is begun. This permits of the bowel being freed from firm residues. Each morning they receive a glass of citrate of magnesia solution. *The aim of specific medicines is to render inert protozoa infecting the intestinal contents and thus prevent infections of the mucosa and to destroy organisms already lodged within the mucous membrane.* Successful therapy depends upon proper isolation of the infecting parasites: entamebæ are particularly susceptible to ipecac or its alkaloid, emetin, while flagellate or ciliated protozoa are slightly affected by these drugs but are readily destroyed by calomel. Thymol is effective against both parasites.

(*a*) *In the entamebœ cases* the patient is put to bed on liquid diet, with hot pads moistened in boracic alcohol mixture over the abdomen (to prevent colicky pains or abdominal discomfort). He is then given by mouth a 10-grain tablet of the aluminum salicylate of ipecac ("alcresta") every hour and $\frac{1}{3}$ grain of emetin hydrochloride hypodermically every four hours for two days.[1] If the stools show diminution of the parasites the dose of ipecac and emetin is then reduced by one-third and this continued for another two-day period. No reduction is made if the parasites are still very abundant or are very active. Usually by the end of the first week the patient is taking 1 to 2 grains of emetin hypodermically daily and 10 grains of ipecac ("alcresta") four times daily. The treatment is continued even when no parasites are seen. Accompanying the medicines given by mouth the colon is carefully lavaged with 4 quarts of hot normal salt solution or a solution of quinin, $\frac{1}{3000}$, and thymol,

[1] We have also administered ipecac in the form of salol-coated pills (as suggested in 1903 by Dock), wine of ipecac by the duodenal tube (after Beck's method), and recently 1 to 3 ounces of wine of ipecac directly into the colon *per rectum*. The last procedure seems to offer a therapeutic regime of much value in severe cases.

$\frac{1}{5000}$, in normal salt solution night and morning. On the sixth day the patient is put on fat-free diet for twenty-four hours (to render thymol administration safe). At bedtime of the seventh day 30 grains of thymol in honey are administered at 8 P.M., and again at 10 P.M. At 6 A.M. the following morning the patient gets 2 ounces of Epsom salt in hot water and all that morning frequent drinks of black coffee, fat-free broth or malted milk. During the second week the emetin, ipecac and bowel irrigations are continued, and usually on the tenth day from the beginning of the treatment two doses of 15 grains each of thymol (preceded by twenty-four hours of fat-free diet) are given in the evening. Daily examinations of the warm stools usually indicate no parasites by this time and the diet may be increased according to the patient's desires, provided it is low in protein and not very bulky. If parasites persist at the end of two weeks, then after thorough colon lavage with hot normal saline solution, from 500 to 1000 c.c. of filtered, commercial kerosene are given per rectum, slowly. The external parts are greased with carbolated vaselin and effort is made to have the patient retain the kerosene for at least one hour. We have never seen any harmful effects follow the use of kerosene. It has proved very efficacious in ridding the bowel of persistent infection.

When the entamebæ are no longer demonstrable in the freshly passed stool, then local treatment of the enterocolitis by large doses (30 grains) of bismuth subnitrate or subcarbonate given five times daily should be carried out. Emetin and ipecac should be continued for at least five weeks, the ipecac alone for three months. The bowel irrigations are usually stopped at the end of the third week. The general state of the patient is taken care of according to indication: HCl after meals if the gastric juice is lacking in acid; iron and arsenic if anemia is present.

(*b*) When *flagellate protozoa* are the infecting organism the treatment is substantially as outlined above for entamebæ except that emetin and ipecac are not used unless there is a concomitant amebiasis. The flagellates are readily destroyed by the administration of evening doses of calomel (5 to 15 grains) followed by 2 ounces of Epsom salt the next day. These doses of calomel are repeated about every five days, according to the indications furnished by the stool examinations. The flagellates are usually less persistent than are the entamebæ with the exception of lambliæ.

(*c*) *After-treatment.* Our study of specimens of gall-bladders and appendices removed at laparotomy indicates that in these parts of the gut cysts of protozoa may lurk for years. Reinfection of the bowel is thus possible. Consequently if these organs have not been removed we insist that our patients have stool examinations at least three times a year and that they go through an abbreviated course of treatment similar to that above outlined. Only in this way do we believe that protozoa "carriers" can be eliminated or reinfection of so-called cured cases prevented.

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EFFECT OF STIMULI FROM THE LOWER BOWEL ON THE RATE OF EMPTYING THE STOMACH.[1]

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It has been shown by Cannon[2] and others that irritation of the colon may delay the emptying of the stomach. This is striking and well known when powerful stimuli occur, as in intestinal injury, in cutting, drying or handling the bowel. Here there is a definite protective mechanism holding back food above until some measure of healing occurs below.

Some men have also emphasized the effect of distention or irritation of the lower bowel by enemata, stasis in the ileum, inflammation of the appendix, adhesions in the ileocecal region, etc., in causing the stomach to empty slowly (Hirsch,[3] Alvarez,[4] Baumstark,[5] Jordan,[6] Eisen,[7] Smithies,[8] Barclay,[9] Cole,[10] Ochsner,[11] Borbjarg[12]). We have studied a group of such cases to find out how frequently this occurs and what sort of irritation gives this result. We have a series of clinical observations and also of animal experiments.

[1] Read at the thirty-second Annual Meeting of the Association of American Physicians, Atlantic City, May 2, 1917.
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